Energy from contaminated waste wood

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In addition to the traditional combustion of biomass it can also be transformed either into a gaseous or liquid fuel, bio-oil. Bio-oil as a 'clean', durable and transportable fuel offers the advantage of being produced centrally and being used de-centrally for power and heat supply. Pyrolysis is an attractive technique to convert also the large flow of contaminated biogenic waste. The concept has been proven on a laboratory scale [1].

As a novel solution, waste wood pyrolysis yields a liquid fuel free of pollutants. At the low pyrolysis temperature of 500 °C, the evaporation of toxic materials is suppressed and all harmful substances are concentrated in the ash [1].

In Europe, 30 million ton of contaminated waste wood accumulates annually. About 3 - 10 wt % of this flow represent wood contaminated with toxic materials like chrome, copper etc. The state of the art in handling this flow is either by depositing in a rubbish dump or by combustion. However, in an increasing number of European countries deposition of material containing organic fractions will be forbidden. Combustion of these materials is an expensive option as in the waste incineration plant high temperatures are required and extensive gas cleaning necessary to meet the rigorous emission standards.

The paper describes the pyrolysis process of wood material. The by-product left from the pyrolysis of contaminated wood is the ash only, in which almost all contaminants in the waste wood are concentrated. Results will be presented for the analysis of both, the ash and the oil. A balance of the material flows will be presented which allows to identify where the various toxic components collect. A major part of the investigation was the combustion of bio-oil derived from contaminated wood in a combustion chamber and a comparison with bio-oil derived from clean wood. The aim is to demonstrate that production of clean energy is possible using contaminated waste wood.

The bio-oil investigated is derived from various wood qualities according to German Wood Standards:

?? Wood class II: Composite wood material as used in ply wood, furniture etc.
?? Wood class III: Chemically treated wood like window frames, doors, wooden balconies, industrial floor boards etc.

At the Institute of Energy and Environmental Technology at the University of Rostock, successful combustion tests with bio-oil derived from clean wood have been performed [2]. Figure 1 shows the combustion test facility with a firing power of up to 300 kW. It is well suited for the investigation of the combustion behaviour of liquid and gaseous fuels and equipped with detailed emission sampling and analysis tools. The flue gas has been analysed in the hot and cold part of the 15 m long flame tunnel. Furthermore, the concentrations before and after passing through the gas cleaning unit with activated coal are measured.
The combustion tests are a forerunner to utilizing bio-oil in a gas turbine.

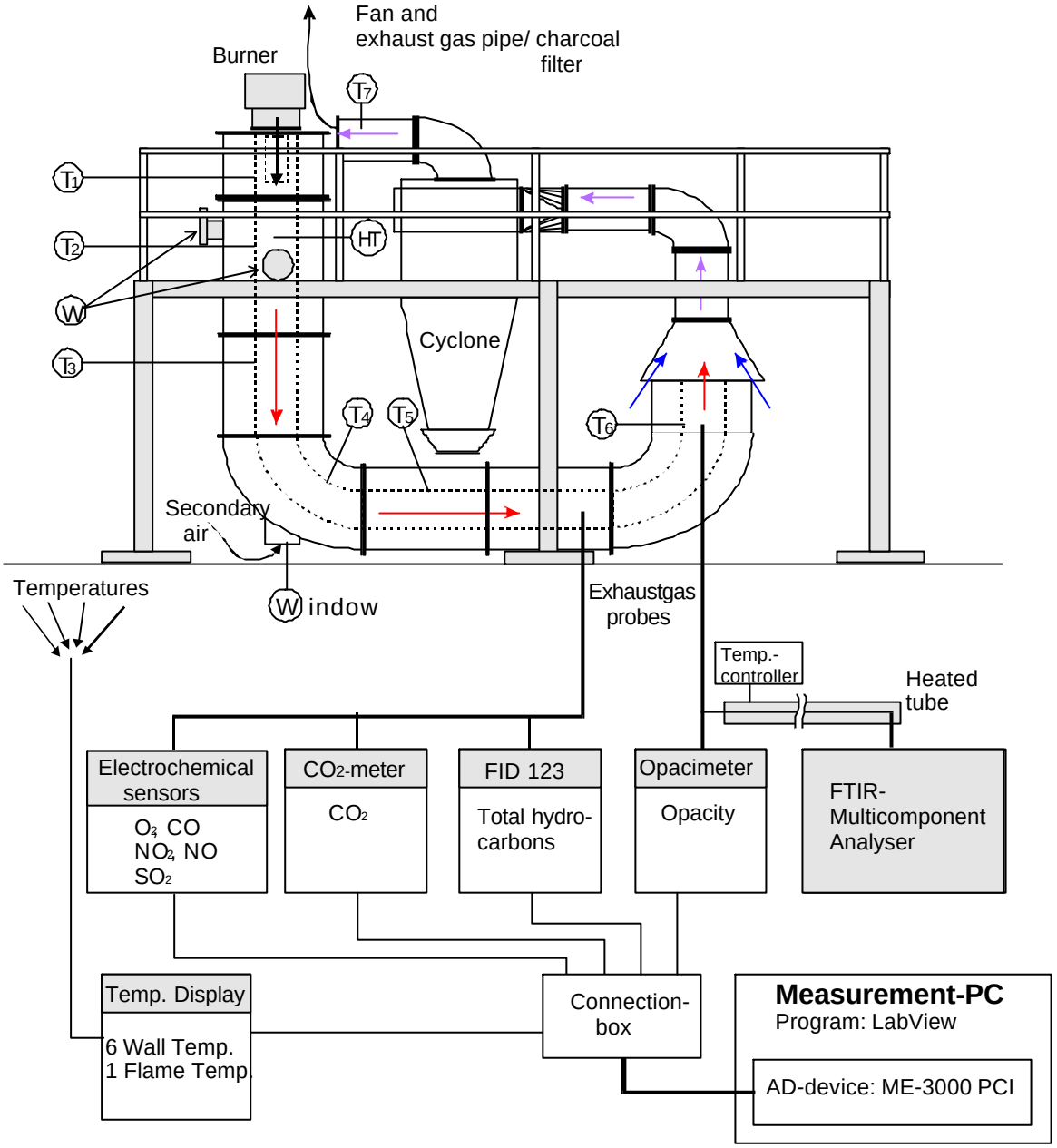

Figure 1. Flame tunnel with exhaust measurement device

References

[1] FAIR- CT97-3203 "Scaling up and operation of a flash pyrolysis system for bio-oil production and application on the basis of rotating cone technology". Final Report December 2000

[2] Anonymus, Marktspiegel Altholz, Holz Zentralblatt, 121, 2395, (1995)